

A NEW DEEP-SEA FISH FROM THE EASTERN NORTH PACIFIC
PSYCHROLUTES PHRICTUS (PISCES: COTTIDAE [PSYCHROLUTINAE])¹

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ABSTRACT: *Psychrolutes phrictus*, new species, is described and compared with its only congener *P. paradoxus*, from which it differs primarily in greater head length (45.3 - 60.6% SL), larger adult size (over 500 mm), color pattern, and greater number of pectoral fin rays (22-26). The systematic status of the subfamily Psychrolutinae is discussed.

Psychrolutes phrictus is a very large benthic cottid, known between Monterey, California, and northern Oregon at depths between 1006 m and 2800 m. Individuals between 34 and 558 mm SL have been collected, all in otter trawls, beam trawls, or benthic fish traps. We examined 19 preserved and three skeletonized specimens.

We concluded from analyses of stomach contents that *P. phrictus* is probably an opportunistic feeder. Stomach contents included 24 different items; the most common of these were sea pens (three species), snails (two species), and crabs (*Chionoecetes* sp.). Among other items found were ophiuroids, fishes, hermit crabs, octopod beaks, and rocks. One specimen (309 mm SL) captured at 1097 m contained otoliths of a large number of pelagic fishes. Capture of individuals of pelagic species by *P. phrictus* probably depends upon those individuals swimming near the bottom; *P. phrictus* does not appear to be capable of pelagic predation.

Since 1960, specimens of an undescribed, very large *Psychrolutes* have been collected off the Pacific coast between Monterey, California, and northern Oregon. The School of Oceanography of Oregon State University has collected individuals between 34 and 469 mm SL on the continental slope off Oregon, at depths between 1026 and 2800 m. Acquisition of small and intermediate-sized specimens has made a complete description of the species possible.

The family Psychrolutidae originally was characterized by lack of a spinous dorsal fin, presence of a suborbital stay, pseudobranchiae, thoracic ventrals, three and a half gill arches, and naked skin (Günther 1861:516). Jordan and Gilbert (1882:686) indicated that *P. paradoxus*, the type species by monotypy, has a spinous dorsal fin although it is buried in loose skin and flesh. Those authors and Gill (1889) believed that differences between Psychrolutidae and Cottidae did not warrant a separate family, and, therefore, included *Psychrolutes* in the latter family. Since then, some authors (Jordan and Starks 1896; McCulloch 1926; Taranets 1941) maintained a separate family designation for *Psychrolutes*; and others (Jordan and Evermann 1896; Jordan

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and Starks 1904; Hart 1973) included the genus in the Cottidae. We follow Gill (1889), and consider the Psychrolutinae as a subfamily of the Cottidae.

METHODS

Counts and measurements follow Hubbs and Lagler (1964) except for counts requiring dissection (pectoral fin, pelvic fin, gill rakers). These were made on the right sides of the specimens. Pectoral and pelvic fin lengths are total (with dissection) to base. Vertebral numbers were obtained from radiographs. Counts as given are the mode, and in parentheses, the range. Morphometric ratios are given as the means, with the range in parentheses; counts and ratios of the holotype are in brackets. Not all measurements were made on all specimens because some individuals were badly deformed during or subsequent to capture. The number of individuals examined (n) follows each range. One specimen (OSUO 2040) was cleared and stained for comparison with *P. paradoxus* specimens that were treated similarly (OS 5300, 5301).

Stomach contents were examined without removal of stomachs from the specimens. Many specimens had otoliths removed before our examination; the otoliths are in the care of John E. Fitch, California Department of Fish and Game. Fitch also removed and examined stomach contents of 16 fish. OSUO specimens were collected by 3 m beam trawl (BMT) and 12 m otter trawl (OTB). Methods of collection for other specimens are written out in materials examined.

MATERIALS

Specimens examined are on deposit at the National Museum of Natural History (USNM), Auke Bay Biological Laboratory (ABBL), California Academy of Sciences (CAS), Natural History Museum of Los Angeles County (LACM), Department of Fisheries and Wildlife, Oregon State University (OS), School of Oceanography, Oregon State University (OSUO), and University of British Columbia (BC).

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Psychrolutes phrictus NEW SPECIES

FIGURES 1 and 2.

Holotype: USNM 216253 (ex OSUO 1839), 1 (383 mm SL, ♀), OTB 92, 44°44.3'N, 125°41.3'W, 2800 m, 24 October 1965.

Paratypes: CAS 32580, 1 (478 mm SL, ♀), sablefish trap, 36°44.5'N, 122°04.5'W, 600 fm (1097 m), 22 April 1975; LACM 35230-1, 3 (495, 522, 558 mm SL, ♀ ♀ ♀), otter trawl, 40°37.3'N, 124°43.0'W, 600 fm, (1097 m), 29 November 1974; LACM 35232-1, 1 (519 mm SL, ♀), otter trawl, 40°37.3'N, 124°43.0'W, 600 fm (1097 m), 14 November 1974; LACM 34338-1, 1 (380 mm SL, ♀), otter trawl?, 40°45.3'N, 124°47.4'W, 700 fm (1280 m), 13 February 1974; LACM 35234-1, 1 (501 mm SL, ♀), otter trawl, 40°45.7'N, 124°44.0'W, 600 fm (1097 m), 3 April 1975; LACM 34185-1, 2 (475, 522 mm SL, ? ♀), otter trawl, 40°45.8'N, 124°43.3'W, 550 fm (1006 m), 26 August 1974; LACM 35561-1, 1 (298 mm SL, ♂), otter trawl? approx. 40°46.0'N, 124°44.0'W, 600 fm (1097 m), 8 August 1972; LACM 30807-4, 1 (508 mm SL, ♀), otter trawl, 41°21.6'N, 124°56.9'W, 725 fm (1326 m), 25 September 1969; OSUO 2057, 1 (440 mm SL, ♀), BMT 419, 42°51.9'N, 124°59.5'W, 1026 m, 17 September 1974; OSUO 2221, 1 (148 mm SL, ♀), OTB 500, 43°22.0'N, 125°09.9'W, 1600 m, 4 April 1973; OSUO 2029, 1 (469 mm SL, ♀), OTB 634, 43°32.0'N, 125°13.0'W, 1580 m, 7 July 1974; OSUO 1524, 1 (399 mm SL, ♀), OTB 64, 44°32.5'N, 125°24.0'W, 2800 m, 9 April 1965; OSUO 2020-2021, 2 (34, 49 mm SL, immatures), OTB 208, 44°36.0'N, 125°10.8'W, 1390 m, 30 October 1967; OSUO 2040, 1 (37 mm SL, immature), OTB 205, 45°51.4'N, 125°15.2'W, 1600 m, 25 October 1967 (cleared and stained).

Additional non-type material: LACM 35771-1, 1 (555 mm SL, ♀), otter trawl, 40°44.3'N, 124°42.3'W, 510-565 fm (933-1051 m), 30 November 1972 (skeleton); LACM 35770-1, 2 (538, 468 mm SL, ♀ ♀), otter trawl, 40°40.5'N, 124°44.8'W, 580-600 fm (1061-1097 m), 27 February 1973 (skeletons).

Other Collections.—Four specimens held at the University of British Columbia were not examined by us. These were collected off Oregon in 1963.

Comparative Material.—*Psychrolutes paradoxus* Günther 1861: OS 5301, 1 (35 mm SL, ?) Lopez Is., San Juan Islands, Washington, 10 July 1963 (cleared and stained); BC 53-260, 6 (27-29 mm SL, ?), Friday Harbor, San Juan Islands, Washington, July 1950; ABBL 72-74, 1 (42 mm SL, ♀), 5 (about 25 mm SL, ?), southeast shore of Favorite Channel, vicinity of beach between Pt. Louisa and Pt. Lena, near Juneau, Alaska, 10 November 1972; ABBL 64-755, 7 (45-48 mm SL, ?), Sta. 755, northeast of Afognak Is., Gulf of Alaska, 58°26'N, 151°51'W, 13 August 1963; OS 5300, 1 (37 mm SL, ?), Kodiak Is., Gulf of Alaska, 15 June 1970 (cleared and stained).

Psychrolutes zebra Bean 1891: Holotype, USNM 45364, sex undetermined, "Albatross" sta. 2848, 55°10'N, 160°18'W, 110 fm (201 m), 31 July 1888.

Diagnosis.—A *Psychrolutes* differing from its only congener in the following: Head large, its length 45.3-60.6% SL; gill rakers on first arch 9-13; pectoral fin rays 22-26. Head with small cirri, especially above eyes and on snout and lower jaw;

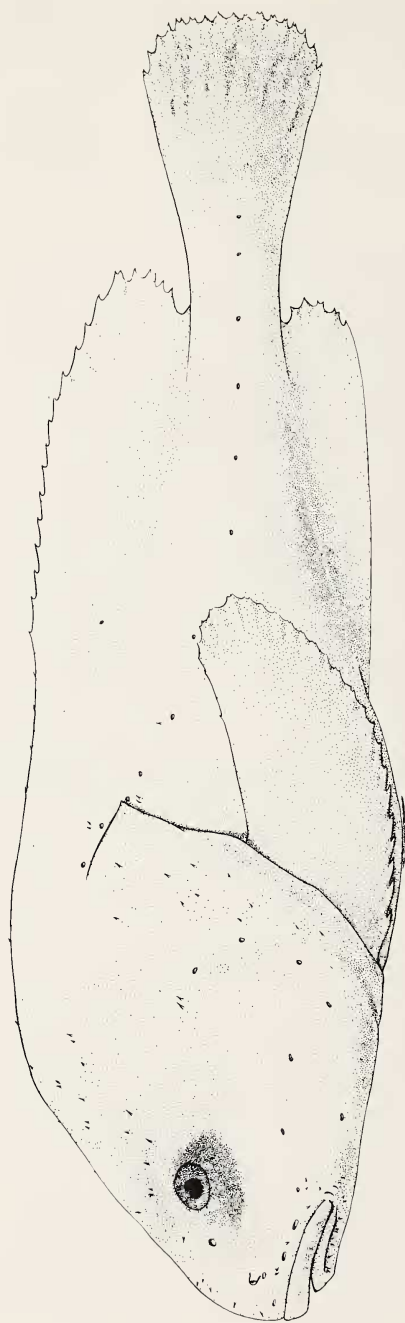


FIGURE 1. *Psychrolutes phrictus*. Holotype; 383 mm SL; USNM 216253.



FIGURE 2. Photograph of *Psychrolutes phricus*. Holotype; 383 mm SL; USNM 216253.

scattered cirri on body. Prickles as well as cirri present on heads and bodies of individuals less than 50 mm SL. Color grayish or blackish, sometimes mottled with white, ventral surface often white, but no distinct banding or sharply defined pattern.

Description.—Dorsal fin rays VIII, 20 [VIII, 20] (VII-IX, 19-20) (n=19), anal fin rays 13 [13] (12-14) (n=19), pectoral fin rays 24 [23] (22-26) (n=19), pelvic fin rays I, 3 (n=19), principal caudal rays about 13 [type not dissected]. Gill rakers on first arch 11 [12] (9-13) (n=19). Lateral line pores 12 [12] (12-14) (n=16). Vertebrae [33] (33-35) (n=4).

Head length 48.9 [50.7] (43.5-60.6% SL) (n=14); eye 1. 12.8 [9.1] (8.6-24.3% head 1.) (n=14), fleshy interorbital width 35.6 [33.2] (24.4-46.4% head 1.) (n=9), pectoral 1. 55.3 [55.4] (44.9-62.3% head 1.) (n=14), pelvic 1. 26.8 [24.1] (23.3-34.7% head 1.) (n=14), snout-anus 109.8 [105.7] (93.8-132.2% head 1.) (n=15).

Allometry is evident over the size range of individuals examined. Small specimens have longer heads, larger exposed portions of the eye, and an apparently narrower interorbital space than large specimens.

Head unusually large, broad, and flattened. In smaller individuals (less than 50 mm SL), depth at occiput about equal to head width; in larger specimens, depth at occiput about 66% of head width. Nostrils two, the anterior with a very distinct tube, about on a horizontal plane with suborbital stay; the posterior on a horizontal line through pupil of eye, distance anterior to eye about equal to eye diameter. Interorbital space broad, slightly convex. Orbits large, orbital rims very poorly ossified, especially in large individuals, dissection required for their accurate measurement. Eyes relatively large, but exposed portion reduced in specimens greater than 150 mm SL. Mouth broadly curved, slightly oblique, lips fleshy; in individuals greater than 150 mm SL, lower jaw distinctly included. Premaxillaries not reaching fleshy rictus; a wide, distinct gap at medial juncture, a narrower gap present at mandibular symphysis. Premaxillary teeth sharp, stout, small and recurved, posteriorly arranged in irregular oblique rows, especially in small specimens, forming band about four teeth wide in individuals less than 50 mm SL, up to eight teeth wide in large (400 mm SL) specimens. Tooth band becoming uniserial posteriorly in small individuals, in larger ones not narrowing much, not uniserial posteriorly.

Cephalic sensory canals well developed, anterior sensory pores large, distinct, posteriormost pores smaller, difficult to distinguish. Five pores in a series above maxillary, eight in the preoperculomandibular series, one nasal pore close and lateral to anterior nostril. Anterior mandibular pores well separated.

Small cirri present on head as slender, short, sharply pointed filaments, usually single, although some on mandible are paired. Mandibular cirri form a line behind lips although no distinct pattern present; other cirri scattered over ventral surface of mandible. Cirri on upper part of head located between maxillary pores, on snout, interorbital region, and posterior to upper orbits. A line of widely separated cirri present along upper orbital margin. Other cirri scattered widely over entire head and body.

Opercular ossification poor, musculature weak, covered with gelatinous layer. Opercular opening long, extending from far above pectoral fin base to just below it.

Body behind opercular flaps tapering rapidly to caudal fin. Pectoral fins broad, well developed, their bases oblique, rays (except uppermost) evenly graduated in

length to shortest ray at anterior (ventral) point of pectoral base. In specimens above 150 mm SL, approximately the 10 lowest rays with distinct fleshy pads on outer tips; in largest specimens, pads very thick, tough, pale colored.

Pelvic fins with one spine and three soft rays. Length of pelvic fin spine about 50% of total fin length, the first (outer) ray almost equal to inner two rays which are about equal in length. Basal half of fin hidden beneath body skin, apparently not very erectile. Distal half of fin free, covered with thick skin, only tips of rays distinguishable without dissection. Pelvic bases narrowly separated. Pelvic fins relatively longer in small specimens.

Dorsal fin with spinous and soft-rayed portions. Anterior spinous portion deeply buried in loose skin and gelatinous tissue, its origin anterior to upper end of opercular opening, spines well developed, stout, although flexible. Spinous portion externally marked by short free filaments above most spines. A shallow notch present between spinous and soft-rayed fin sections. Soft dorsal fin rays becoming gradually longer posteriorly, fin becoming high and distinctly lobate at its end. Anal fin well developed, of soft rays only, its origin below anterior dorsal fin rays.

Anus distant from origin of anal fin, anterior to a vertical through pectoral tips. Body covered with thick, tough skin, naked, except in specimens less than 50 mm SL, which have simple, sharp, slender prickles distributed over body except head and parts of fins, especially dense around anus. Larger individuals with a thick gelatinous layer between skin and musculature, often with distinct, yellowish fat deposits in concavities of muscles and bones. In specimens greater than 300 mm SL, skin extensively marked with pale lines, circles, and other evidences of injury. Largest specimens (above 400 mm SL) with very distinct areas irregularly covered with pale rings, often overlapping in great numbers. We believe the rings are sucker marks of cephalopods, a known food item. Patterns of rings fit the disposition of suckers on octopod arms.

Lateral line consisting of 12-14 open pores, usually well spaced, but occasionally with two pores close together. Posteriormost two pores located on caudal base or on caudal fin itself. Anteriormost lateral line pore reduced, above gill opening.

Color of skin grayish or blackish dorsally, often pale ventrally, with indistinct mottling especially on head. Mouth pale, opercular cavity pale, peritoneum pale, stomach pale.

Food Habits.—Although the data obtained through examination of stomach contents do not warrant statistical analysis, some speculations are possible about the feeding habits of *P. phricus*. This species apparently has a varied diet; a total of 24 different food items was found in the 25 stomachs examined. The most frequent food items were sea pens (*Stylatula* sp., *Balticina* ? sp., *Funiculina* sp.) in 12 fish; crabs (*Chionoecetes* sp.) in 15 fish; and snails (*Buccinum* sp., unidentified sp.) in 13 specimens. Other food items were *Sebastolobus alascanus*, *Sebastes* sp., octopod beaks (in 4 individuals), ophiuroids, a plastic bag, rocks, hermit crabs (*Pagurus* sp., *Parapagurus* sp.), and possible anemone, sea cucumber, and crinoid remains. One fish, LACM 35561, 309 mm SL, contained a large number of otoliths of *Nansenia* sp. and *Lestidium* sp. in its stomach, plus otoliths of *Sebastes* sp. and *Tetragonurus* sp. Except for *Sebastes*, all are known to be pelagic. Although this individual was the smallest

with stomach contents, we have no other reason to believe it was pelagic. Several of the OSUO specimens were smaller, and were captured with bottom trawls. Because the anatomy of *P. phrictus* is typical of a demersal cottid, we believe that the pelagic species ingested must have become available by swimming near the bottom. The possibility that individuals of *P. phrictus* as small as 300 mm are pelagic is unlikely because all specimens, including those smaller than 300 mm, were taken by bottom trawl.

The presence of octopod beaks in the stomach contents is clear evidence that *P. phrictus* sometimes eats octopods. This may account for the scars on the skin of the head in large specimens. Some of the beaks are large: specimen OSUO 2029, 469 mm SL, contained a beak from an octopod estimated (by the method of Clarke 1962) to weigh about 1 kg.

Distribution.—*Psychrolutes phrictus* occurs along the middle and lower continental slope from Monterey (1097 m) to Eureka (1006-1326 m), and off Oregon (1026-2800 m). Its meridional distribution may be wider, especially towards the north where there seems to be no hydrographic or geologic features that might act as barriers.

Males and females may be distributed differently. Of the 25 specimens of known sex, two are males and only one of the 19 fish we examined was a male (LACM 35561-1, 298 mm SL). The other male specimen (Calif. Fish and Game, Eureka Lab. No. 68, 475 mm SL) was not seen by us. Perhaps males are segregated in rocky areas where trawling is difficult.

Etymology.—From *φρικτος* (phrikτος), Greek, "causing one to shudder," from the grotesque appearance of the species.

Relationships.—*Psychrolutes phrictus* is provisionally thought to be most closely related to *P. paradoxus* Günther 1861. It is distinctly different in the following respects: the head is relatively longer, especially in small specimens; those of 37 to 58 mm have head lengths of 49.6 to 60.6% with the overall range 45.3-60.6% of SL vs. *P. paradoxus* 40.2-44.4%; it has a larger pectoral fin of 25 (22-26) rays vs. *P. paradoxus* 21 (20-22) rays. It has cirri whereas *P. paradoxus* has large numbers of stout, blunt, papillae over its entire body, including outer surfaces of the fins; small specimens have many sharp exposed prickles whereas large *P. paradoxus* have a few in two ventrolateral rows beneath the skin. Its two inner pelvic fin rays are about equal, with the outer ray slightly shorter; *P. paradoxus* has pelvic fin rays evenly graduated in length, the outer shortest. Body color is generally evenly grayish, blackish, or mottled, whereas that of *P. paradoxus* is brown or black, in sharply defined bars or blotches on a light background, in a consistent pattern. Maximum size is at least 558 mm, whereas that of *P. paradoxus* is 58 mm (Hart 1973:534). Depth distribution differs: *P. phrictus* occurs between 1006-2800 m, but *P. paradoxus* is found between 55-220 m (Hart 1973:534).

Discussion.—This is the only other species beside *P. paradoxus* now referred to *Psychrolutes*; two other species were described but later removed from the genus or synonymized. *Psychrolutes latus* Hutton was redescribed by Günther (1876) as the type of a new genus, *Neophrynichthys*; *Psychrolutes zebra* Bean (1891) was synonymized with *P. paradoxus* by Jordan and Evermann (1896:2027), with whom we agree.

The relationships of *Psychrolutes* and closely related genera (e.g. *Neophrynichthys* Günther and *Cottunculoidea* Barnard) are not well known; the characters separating them are unclear. If future investigations result in merging of these genera, *Psychrolutes* will be the senior synonym. We have placed the new species into *Psychrolutes* because it agrees with the generic description of the following characters: Lack of spines on the head, lack of opercular spines, pelvic fins I, 3, lack of scales on the body, seven branchiostegal rays, vomerine and palatine teeth absent, and dorsal fin spines completely buried in flesh or gelatinous tissue. Comparison of *P. paradoxus* and *P. phrictus* using the above characters leaves little doubt that they are closely related.

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